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## **Interoffice Transport Cost Studies**

Interoffice transport consists of the facilities that carry calls between central offices. The facilities are either dedicated, meaning they are used solely for transport, or common, meaning they are shared with other purposes, such as distribution or feeder. Interoffice transport facilities consist of entrance facilities, multiplexing facilities, interoffice facilities, and cross-connects. SWBT has separate cost studies for dedicated and common interoffice transport. Concerns for both dedicated and common transport, summaries of the cost studies, and a description of COSTPROG are presented below.

### **Purpose**

The purpose of the unbundled dedicated transport cost study is to calculate the forward looking long run incremental recurring and non-recurring costs for DS-1 and DS-3 unbundled dedicated transport entrance facilities and unbundled dedicated interoffice facilities. The study also includes unbundled costs for cross-connects.

### **Concerns**

After reviewing the interoffice transport cost studies and models used to develop investment and cost, concerns with fill factors and accuracy of the data were identified. Both concerns apply to both dedicated and common transport. By fixing the problem in COSTPROG, the econometric model used to identify interoffice transport investment, the problem will be alleviated in both studies. SWBT uses non-forward looking fill factors for the electronics and fiber facilities in interoffice transport. SWBT utilizes a Busy Hour / Total Day ratio of 10% with little or no evidence to support this assumption. This concern is minimized by the fact the AT&T/MCI use this same value as their input into the Hatfield Model 3.1.

**Use of actual fill factors** -- SWBT uses actual fill factors for interoffice transport electronic circuits and fiber. Staff believes that forward-looking fill factors are more appropriate.

Synchronous Optical Network (SONET) terminal equipment exists where dedicated transport circuits enter/exit the SONET ring. The equipment converts electrical signals to optical signals and multiplexes the signals to the speed of the SONET ring. SONET terminals, known as Add-Drop Multiplexers (ADM), consist of a high speed side and low speed side. The high speed side connects to the fibers and transmits the signals. The low speed side consists of DS-1 or DS-3 circuit cards which are modular, meaning that as

demand for more capacity increases, more circuit cards may be added.

A fill of **\*\* \_\_\_\_ \*\*** percent on the fast side electronics is appropriate and forward looking. The value is appropriate because SONET technology is new within the last 15 years and its capabilities are limited by the connecting electronics. Because of the modular nature of the slow side, the fill factor should be 85 percent. The reason for this high fill is because the slow side consists of only a cabinet and line cards -- where each card is modular and operating close to its capacity.

It is not clear what the unused fiber strands will be used for in the interoffice transport cost study and therefore should not be included as a cost for interoffice transport. Instead the investment in unused fiber should be recovered by making the fiber available for competitors to purchase as dark fiber. Therefore, a fill factor of 90 percent is appropriate. A fill factor in this range would allow for the actual use of the fiber, account for dark fiber, and allow for a breakage factor (or fibers that are unusable). The investment in additional fiber can be recovered through dark fiber. (For further information on the fill factor for dark fiber, see the dark fiber section).

**Busy Hour / Total Day.** SWBT's cost studies use 10% for the Busy Hour/Total Day value. SWBT did not provide a study or data to support that 10 percent of calls occur in an average busy hour on an average busy day. If on average, more calls are placed in that busy hour, the costs will decline, while if less calls are placed, the costs will increase. An empirical study would be useful in determining the accuracy of this value and making the cost study more accurate. If the results of the research suggest a different value, that value should be used.

Staff notes that AT&T/MCI use the same 10% figure in the Hatfield Model 3.1 runs for SWBT. Because both parties use the factor, Staff did not pursue modifications.

## **Summary of Studies**

### **Dedicated Transport**

The purpose of the unbundled dedicated transport cost study is to calculate the forward looking long run incremental recurring and non-recurring costs for DS-1 and DS-3 unbundled dedicated transport entrance facilities and unbundled dedicated interoffice facilities. The study also includes unbundled costs for cross-connects.

An entrance facility is the transmission path between customer premises and the serving central office. DS-1 entrance facilities are equipped to provide 1.544 Mbs capability while DS-3 entrance facilities are equipped to provide 45 Mbs capability. Both facilities are capacity derived and based on an OC3 multiplexing system.

Interoffice facilities consist of an optical transmission path over OC3, OC12, or OC48 Synchronous Optical Networks (SONET). A SONET facility is a family of fiber optic

transmission rates created to provide the flexibility needed to transport many digital signals with different capacities and to provide a standard manufacturing design. SONET defines a physical interface, optical line rates known as Optical Carrier (OC) signals, frame format and an Operations, Administration, Maintenance, and Provisioning protocol. The OC signals have their origins in electrical equivalents known as Synchronous Transport Signals (STSS). For SWBT, the costs are based on a weighted average of bi-directional SONET rings and collapsed SONET fiber based chains. Each cost element represents a path between serving central offices or nodes on the ring or chain. When a transmission path is required to include multiple rings or chains, the investments are calculated based on interconnection at a single node.

Recurring costs for each element are based on forward-looking fiber based network. The entrance facilities are based on a sample consisting of all types of loops provided by SWBT. The sample is divided into three groups: Rural, Suburban, Urban. The groups are based on central offices by rate group from the current Local Exchange Tariff. The investments for each element are based on 1996 cable broadgauge costs and multiplexing equipment investments provided by SWBT's procurement department.

The DS-1 and DS-3 cost design characteristics are derived by the circuit process on all OC types of rings and chains. The investments for each element are the results of capacity calculations based on the total capacity of the ring or chain network. The recurring costs are based on A (originating) to Z (terminating) networks from four zones in Missouri. The zones are metro, suburban, rural, and interzone (between zones). The central offices were identified and categorized into their respective zones based on rate group calling areas in the Local Exchange Tariff. Costs for each zone are calculated to represent the first air mile, then each additional air mile. The first mile includes SONET multiplexing equipment and the first air mile investments for the fiber cable. Each additional mile includes only the fiber cable.

Cross-connects consist of the distribution equipment used to terminate and administer communication circuits. In a wire cross-connect, jumper wires or patch cords are used to make circuit connections. In an optical cross connect, fiber patch cords are used. The costs associated with cross-connects are incurred through the facilities to and from interconnector designated equipment. The costs associated with digital cross-connect systems (DCS) are derived from designs associated with a 3/1 system.

Recurring costs for cross-connects represent the cost of equipment required to meet the technical parameters of the cross-connect element. The designs consist of transmission equipment configurations, fiber distribution frames, and optical jumpers for various optical cross-connects. DCS cost include charges for establishment, database modification, arrangement, customer performed reconfiguration, plus DS-1 and DS-3 channel ports.

Non-recurring costs associated with dedicated transport facilities include expensed labor efforts required to provide service to a customer, and includes both installation and disconnection activity. The dedicated transport cost study does not include maintenance costs. A detailed description of non-recurring charges may be found in the Summary of

Non-recurring Charges.

### **Models Used in the Dedicated Interoffice Transport Cost Study**

COSTPROG, LOOPVEST, and ACES are the models used to determine investment and cost for each element related to dedicated transport. COSTPROG is the primary source and is used to determine investment for the electronics and fiber for interoffice transport. COSTPROG basically identifies the routes a call may take to be completed and selects the least cost route. Investment is derived from the number of circuits in a network and the amount of interoffice fiber. Total investment in interoffice fiber is separated into aerial, buried, and underground sections and an investment for each is identified. The investment values for interoffice electronic facilities and interoffice fiber are fed into ACES.

LOOPVEST is used to determine investment and costs related to the entrance facilities. Entrance facilities consist of building cable, poles, aerial cable, DLC equipment, premises equipment, frame equipment, buried fiber and copper cable, copper, conduit, and underground fiber and copper cable. Investment for each element is identified through LOOPVEST. For further information on LOOPVEST, see the section discussing the loop cost studies. The investment values are then plugged into ACES.

Investment for cross-connects are derived from the equipment needed for optical cross-connects and DSX-3 cross-connects (DCS). Investment for optical cross-connects is related to the investment in two optical riser cables, and the investment in DCS is related to investment in two DSX-3s. Investment in DCS is related to DS0, DS-1, and DS-3 ports. These investment values are plugged into ACES.

Through ACES, factors related to power, buildings, depreciation, cost of money, income tax, equipment expenses, building and grounds maintenance, administrative expenses, ad valorem taxes, and a Commission assessment are applied to determine an annual recurring cost. This annual cost is divided by twelve to determine monthly cost associated with dedicated transport.

### **Common Transport**

The unbundled common transport cost study develops a cost per minute, per mile for common interoffice transport facilities. The facility cost per minute, per mile represents the cost of facilities required to establish the talking/conversation path and maintain the path for the duration of a call between different central offices.

To determine costs related to common transport, investment per mile for facility for each of the four zones from COSTPROG was converted to cost through ACES. The annual costs were converted to minutes of use to yield a facility cost per minute, per mile. Included in common transport are the interoffice fiber facilities and the termination equipment. The interoffice fiber is based on a cost per minute, per mile. The termination

equipment is based on per minute of use.

### **Explanation of SWBT's COSTPROG Model**

COSTPROG is the model SWBT uses to calculate investment associated with common and dedicated interoffice transport. The model develops interoffice investments on fixed and per mile bases. Fixed investments are related to the electronics within a central office and per mile investments refer to the fiber lines between central offices. The model calculates investment for cross connects with SMAS test equipment, and non-recurring charges associated with 8 db, 5 db, ISDN-BRI, and DS-1 loops. The investment resulting from COSTPROG's calculations is plugged into ACES to generate cost.

COSTPROG calculates investment based on originating and terminating locations of a circuit. To do this, the model generates the route of a call. The route may be a chain of central offices, a ring of central offices, or a combination. A chain is composed of terminal and intermediate add/drop multiplexers. A ring is composed of pass-thrus where the signal enters or exits the network, and nodes where circuits access the interoffice transport.

A different investment is derived for each rate band: urban, suburban, rural, and interzone. For each rate band the COSTPROG process consists of

- 1) Design inputs
- 2) Generating Routes
- 3) Generating Service Files
- 4) Generating Investment Studies
- 5) Investment is plugged into ACES.

### **Design Inputs**

Data for COSTPROG are obtained from the Trunks Integrated Records Keeping System (TIRKS) database, broadgauge, and procurement. Assumptions about the data and content of the database are summarized as follows:

- Cost information on equipment is obtained from procurement records. Installation cost data include SWBT engineering and contractor costs.
- The data used was last updated in 1994; SWBT is currently making a new update.
- The network design is obtained from network engineers and is based on facilities currently in place and facilities being placed over the next five years. The network design includes SONET and fiber investment.
- COSTPROG uses the entire data universe (not a sample).
- Data used in COSTPROG consist of originating and terminating locations by

Common language location identification (CLLI) code, total fixed investment in the route, fiber investment, number of circuits, route miles, air miles, route/air ratio, and billing band. Route miles is no longer used and air miles is used in its place for determining rates. Billing band is determined by the route being urban, suburban, rural, or interzone.

- Total fixed investment and fiber investment are derived in COSTPROG.
- Data are generated on how many networks (chain or ring) are crossed to complete a call. Data on the networks are contained in the SONET database. The SONET database contains network ID, LATA, speed (optional carrier 3, 12, or 48), network type (chain, one ring, fiber bidirectional), and number of nodes. For each leg in the network the following are used: originating (A) and terminating locations (Z), cable size, and route length.

### **Generate Routes**

In this step, COSTPROG sorts through all possible routes a call may follow over a network and selects a least cost route. Assumptions about how routes are generated are summarized as follows:

- Investment data on fiber per foot, innerduct per foot, chain and ring in conjunction with network data are used to calculate investments and determine connected networks.
- The data are sorted according to routes a call may take. A least cost path is then determined from all possible routes.
- Data are summarized by number of nodes in the network to find total fiber investment and investment per fiber strand.
- The following calculations are then made for each network:
  - 1) Investment per Chain = Cost per Node / Capacity of DS-1.
  - 2) Total Fixed Investment per Network =  
Investment per Chain + Interconnection Investment + Network Access,

where Interconnection Investment and Network Access are obtained from engineering.

- 3) Total Fiber Investment per Pair per Network =  
(Investment per Single Fiber / Capacity of DS-1) \* Number of Nodes,

where, the number of fibers and nodes are obtained from engineering.

- 4) Fill factors are applied to the total investment in each network crossed.

### **Generate Service Files**

In this step COSTPROG identifies the total number of circuits within a network and within a rate band. These values are then used to generate the investment studies.

### **Generate Investment Studies**

COSTPROG generates fixed and fiber investment for least cost routes for all originating and terminating locations. Assumptions regarding how investment studies are generated are summarized as follows:

- The values of Total Fixed Investment per Network and Total Fiber Investment per Pair Network are then weighted according to the number of circuits in the network by:

$$(\text{Fixed Investment} * \text{Number of Circuits}) / \text{Total Circuits in Network}$$

- This is determined for each network for the fixed (electronics) investment. The values for each network are then summed producing Total Raw Fixed Cost, which is plugged into ACES to determine cost related to the electronics in a central office associated with interoffice transport.
  - The result from ACES is annual termination cost.
- Weighting of circuits for fiber is done as

$$\text{Fiber Investment} / \text{Air Miles} * \text{Number of Circuits} / \text{Total Circuits in Network}$$

- This calculation is applied to each network for the fiber investment. The values for each network are then summed producing Raw Fiber Investment, which is plugged into ACES to determine the cost related to the fiber between central offices associated with interoffice transport.
  - The result from ACES is annual facility cost per mile.

## **Local and IntraLATA Operator Assistance**

### **Purpose of Study**

The purpose of this study is to determine the forward-looking TELRIC associated with providing Operator Assistance. The service is currently offered to the Independent Exchange Companies (IEC) and the Competitive Local Exchange Companies (CLEC) in Missouri.

### **Concerns and Proposed Modifications**

Staff has no specific concerns or proposed modifications to this study other than the Proposed Modifications Affecting All Studies (Cost of Money, Depreciation, etc.).

This service is currently offered to other IECs in Missouri and intercompany compensation arrangements are currently in place. Since this is already a market price and these services are not bottleneck or monopoly services, Staff recommends the use of the lowest intercompany compensation arrangement SWBT currently has in place. If SWBT agrees to a lower intercompany compensation arrangement in the future, that rate should be made available to AT&T and MCI.

## **Directory Assistance**

### **Purpose of Study**

The purpose of this study is to determine the forward-looking TELRIC associated with providing Directory Assistance. The service is currently offered to the Independent Exchange Companies (IEC) and the Competitive Local Exchange Companies (CLEC) in Missouri.

### **Concerns and Proposed Modifications**

Staff has no specific concerns or proposed modifications to this study other than the Proposed Modifications Affecting All Studies (Cost of Money, Depreciation, etc.).

This service is currently offered to other IECs in Missouri and intercompany compensation arrangements are currently in place. Since there is already a market price and these services are not bottleneck or monopoly services, Staff recommends the use of the lowest intercompany compensation arrangement SWBT currently has in place. If SWBT agrees to a lower intercompany compensation arrangement in the future, that rate should be made available to AT&T and MCI.

## **Directory Assistance Call Completion**

### **Purpose of Study**

The purpose of this study is to determine the forward-looking TELRIC associated with providing Directory Assistance Call Completion. The service is currently offered to the Independent Exchange Companies (IEC) and the Competitive Local Exchange Companies (CLEC) in Missouri. This service allows the customers of IECs or CLECs who request a number for Directory Assistance with the option of having their call completed by the Directory Assistance operator or audio response system that provides the requested directory number.

### **Concerns and Proposed Modifications**

Staff has no specific concerns or proposed modifications to this study other than the Proposed Modifications Affecting All Studies (Cost of Money, Depreciation, etc.).

This service is currently offered to other IECs in Missouri and intercompany compensation arrangements are currently in place. Since this is already a market price and these services are not bottleneck or monopoly services, Staff recommends the use of the lowest intercompany compensation arrangement SWBT currently has in place. If SWBT agrees to a lower intercompany compensation arrangement in the future, that rate should be made available to AT&T and MCI.

## **Dark Fiber**

### **Purpose**

This study identifies the Forward-Looking TELRIC associated with providing dark fiber as an unbundled element. Dark Fiber is the unlit or unused fiber strands currently in place throughout the existing network. These fiber strands do not have any electronics attached to them and are not being used to provision services.

### **Proposed Concerns and Modifications**

**Fiber Termination** - SWBT's proposed charge for dark fiber recovers the investment for fiber termination on distance sensitive or per mile basis. Fiber Termination investment include the costs for fiber distribution frame and the pig tails used to connect equipment to the fiber distribution frame. These costs are not incurred on a distance sensitive basis. They are incurred each time a fiber optic cable terminates to a central office or the customer premises. For this reason, these costs should not be recovered on a distance sensitive basis.

Staff recommends these costs apply per termination on a monthly basis. Recovering the costs in this manner more accurately matches the manner the costs are incurred with the rate structure. This modification should not affect the overall cost of dark fiber.

**Fill Factors** - Staff disagrees with SWBT's fill factor for dark fiber. SWBT's rationale is that it will be unable to either lease or use all of the dark fiber and should recover that investment through the use of the fill factor. The reasons that SWBT will be unable to lease or use fibers are:

- Because of breakage, some of the dark fiber strands or the fibers strands currently in use will not be physically able to be used.
- SWBT will be unable to use or lease all of its dark fiber because of insufficient demand from CLECs or internal uses.
- SWBT needs to reserve fiber for its own future use.

Staff agrees with first reason but disagrees that the use of fill factor is necessary for the other two reasons.

Because of breakage, some of the fiber strands will not be able to be used. In the case of dark fiber, the strands will never be able to have electronics attached to them. In the case of fiber strands currently in use, something may happen to render that fiber useless so SWBT needs to have some fibers in reserve to use in its place. Staff feels that it is appropriate to recover this investment through a fill factor applied to dark fiber.

Using a fill factor for the second reason is inappropriate. If SWBT is allowed to use a low fill factor (low usage percentage), SWBT will be allowed to recover fiber investment without ever making the fiber available or using for its own use. If this occurs, SWBT will have no incentive to lease dark fiber to any other carriers. If SWBT wants to keep dark fiber for its own use, it should recover that investment when the fiber is used. SWBT should not be allowed to require current customers to pay for services for future customers.

Staff also disagrees with the last reason SWBT uses for justifying its fiber fill factor. Fiber reserved for SWBT's future use is recovered in the fill factors used in other rate elements. For example, Interoffice Transport contains a fiber fill factor. The purpose of that fill factor is allow SWBT to recover the investment for fiber that is anticipated to be used in the near future. Under the terms of leasing dark fiber, SWBT has the right to reclaim any fiber leased to another party for its own use if necessary. Since that process may take some time, SWBT should be allowed to retain some fiber for short-term usage. However, that investment is reflected in the fiber fill for other elements and does not also need to be recovered in the dark fiber element.

To allow for breakage, Staff proposes that SWBT use 95% fill factor on dark fiber. This would allow SWBT to retain 5 percent of its fibers for breakage.

### **Summary of Study**

The costs for dark fiber are based upon the current SWBT costs as listed in the 1996 Broadgauge Cost. The per foot fiber costs include underground and buried investments and are weighted based upon the current placement percentages. These investments include placement, conduit, innerduct, and pass-through and end fiber terminations at the serving central offices and the premise terminations. The fiber terminations are converted to a per foot investment based upon the average number of terminations per mile from the DS-1 Interoffice Study. The dark fiber investment contains a \*\*\_\_\*\* fill factor. This means that of the dark fiber strands in the network, \*\*\_\_\*\* will be leased to other CLECs or used by SWBT in the future. The remaining \*\*\_\_\*\* will still be unused and that associated investment needs to be recovered from the dark fiber leased to CLECs or used by SWBT in the future. The rationale for the use of a fill factor is discussed in more detail in the Concerns and Proposed Modifications Section. Finally, monthly costs are derived by applying the investments to the ACES model.

## **Summary of the ACES Cost Model**

### **Purpose**

This model applies various capital and cost factors to the incremental investment derived from SWBT's other network investment models. This is necessary to convert the incremental investment into a monthly cost.

### **Concerns and Proposed Modifications**

**Building Factor** - The numerator in the building factor model begins with the booked investment in network and other buildings and uses the account specific CC/BC (current cost/booked cost) ratio to calculate the replacement cost of the buildings. This assumes that if SWBT were to replace the buildings today, they would build exactly the same number and size of buildings in the same locations. In reality, a truly forward-looking building investment would have to recognize that the increases in digital switch capacity would require fewer wire centers and fewer buildings to house the wirecenters. In addition, a forward-looking building factor would have to recognize that network building built today would be smaller than existing buildings because switching equipment has physically gotten smaller and the companies have adopted the host/remote technology which reduces space requirements.

The FCC's Interconnection Order (Order) required the use of the existing wire centers which is one thing in the Order that the incumbent LECs tend to agree with. However, the use of the current wire center locations was not intended to be a forward-looking costing standard. ¶ 685 of the Order states that, "the forward-looking pricing methodology for interconnection and unbundled elements should be based upon costs that assume that wire centers will be placed in the incumbent LEC's wire center locations". The Order goes on to say that "this approach encourages facilities-based competition to the extent that new entrants, by designing more efficient network configurations, are able to provide the service at a lower cost than the incumbent LEC." This clearly recognizes that the current wire center locations are not the most efficient but using the current wire center locations would produce economic costs that most closely resemble those the LEC would face. Given that the use of the existing wire centers was not a forward-looking assumption, it seems inappropriate to then inflate the costs of the existing wire center location, namely the building, in an attempt to make this a forward-looking assumption when it was never intended to be forward-looking. If we were to develop a forward-looking building factor, we would also have to consider the fact that fewer wire centers

would be built.

Even if the same number of buildings were to be rebuilt, the physical size of most of the equipment housed in the buildings has been reduced dramatically so SWBT would not build the same size of building. For these reasons, this factor, as calculated, overstates the investment in network and other buildings.

An additional consideration is the issue of double recovery of building investment. As calculated by SWBT, this factor would assign all forward-looking building investment to the network elements. SWBT will also recover building investment from collocators through individual case basis (ICB) pricing contracts for leasing central office space. Allowing SWBT to recover building investment from both sources would lead to a double recovery of investment. One option would be to not allow SWBT to include building investment in the ICB pricing calculation. This would drastically reduce the ICB and probably cause collocators to request more space than they actually need resulting in an inefficient use of floor space.

The best approach to allowing SWBT to recover the forward-looking investment in buildings would be to determine the percentage of space available for collocators and remove that investment from the building factor. The remaining space that is used to house network equipment would be recovered by applying the building factor to the network investment. Unfortunately, there is no Missouri specific data on the amount of excess floor space available to collocators so this was not possible.

The most practical approach and the modification proposed by Staff would be to use the historical investments in determining the building factor. This would allow SWBT to recover its investment in buildings but will not build in the costs of replacing the existing buildings. The issue of double recovery would still exist but to a much less extent than if the current investment required to replace the existing buildings were used. In order to be consistent, the building and grounds maintenance factor should be adjusted to reflect the lower historic building investment. This will increase the building and grounds maintenance factor.

### **Building and Grounds Maintenance**

The Building and Grounds Maintenance Factor is calculated by dividing the Building and Grounds Maintenance Expense by the Total Replacement Cost for the Mid-Year Investment in the Buildings and Land Accounts. To be consistent with the recommended changes to the Building Factor, the investment in the maintenance factor should be reduced to the historic investment in building and land. In other words, the building factor and the building maintenance factor should be calculated using comparable investments. As the Maintenance Expense in the numerator remains constant, this adjustment will increase the Building and Grounds factor.

## **Inflation and Productivity Factors**

See Inflation and Productivity Factor Modifications Section.

## **Summary of ACES Cost Model**

The ACES model has three primary costing sections. Each of these categories represents a type of cost applied to the investment. The categories are Equipment Investment, Annual Capital Costs, and Annual Operating Expenses. Each of these is described in greater detail below.

**Section 1 - Equipment Investment:** The purpose of this section is to identify the additional expenses associated with procuring, installing, housing, and operating the incremental investment input from other SWBT cost models. The inputs for this section are described below.

**Equipment Investment (EF&I):** This factor is the incremental investment for each network component. This input comes from SWBT's other cost models such as Loopvest and SCIS.

**Ratio of Material to Total EF&I:** This factor is intended to recover the percentage of investment that is actually material. This is the cost of the vendor material excluding vendor design costs to design, engineer and install the investment. The purpose of this input is to determine the percentage of investment that is subject to sales and use taxes.

**Sales Tax:** This factor is intended to recover the statewide average sales tax percentage that SWBT paid in 1995. It is the total sales dollars paid in 1995 divided by the 1995 total purchases subject to sales tax.

**TELCO Engineering:** This factor is intended to recover the labor cost of SWBT engineers to design and engineer the installation and placement of the equipment. It is calculated by dividing the 1993 - 1995 total TELCO Engineering Labor by the Total Vendor Material and Expenses Related to EF&I for 1993 - 1995. Three years of data are used in the calculation to normalize the expenditures.

**TELCO Plant Labor:** This factor is intended to recover the labor cost incurred to actually install the equipment. It is calculated by dividing the Total Plant Labor for 1993 - 1995 by the Total Vendor Material and Expenses Related to EF&I for 1993 - 1995. Again, three years of data are used in the calculation to normalize the expenditures.

**Sundry & Miscellaneous:** This factor is intended to recover the miscellaneous costs associated with purchasing the equipment or investment. This includes the

Interest Paid During Construction, Contracted Labor, and other miscellaneous costs. It is calculated by dividing the Total Sundry and Miscellaneous Expense for 1993 - 1995 by the Total Vendor Material and Expenses Related to EF&I for 1993 - 1995. Again, three years of data are used in the calculation to normalize the expenditures.

**Power:** This factor is intended to recover the cost of electrical equipment needed to operate telecommunications and computer equipment. This factor does not include the actual power expenses, just the capitalized power equipment. It is calculated by dividing the Cost of Power Equipment Assigned to the Network Components by the Equipment Investment for Network Components. This factor is not account specific. The Cost of Power Equipment Assigned to the Network Components is allocated to different asset categories based upon historical embedded investment in Network Components. Unlike the other cost factors that allocate expenses based upon investment, no adjustment is made to the network investment to make it reflect the replacement cost. This adjustment is not made because this is an investment to investment ratio.

**Building:** This factor is intended to recover the building investment associated with housing network equipment. It does not include headquarters and administration buildings. This factor is only applied to investments that require buildings. It is calculated by dividing the Building Investment for Network and Other Buildings by the Network Investment for Switching, Operator Systems, and Circuit Equipment. The historical Network Investment for Switching, Operator Systems, and Circuit Equipment is multiplied by an inflation factor to calculate the replacement cost for Network Investment. The inflation factor used in this calculation is called the CC/BC (current cost/booked cost) ratio. This is included in an attempt to make the factor forward-looking.

The use of the CC/BC ratio in the equation results in a cost factor designed to recover the building investment assuming that exactly the same number, size, and location of the buildings would be rebuilt today. In reality, if the network were to be rebuilt it is very doubtful that the same number of wire centers would be necessary. In addition, the actual equipment housed in the buildings has physically gotten smaller so the building space required should also be reduced. Finally, SWBT generates revenue by leasing space for physical collocation so it would not be appropriate to include the entire building investment in the building factor. Considering these facts, the use of the CC/BC ratio will overstate the "true replacement cost" of SWBT's buildings.

**Section 2 - Annual Capital Cost:** The purpose of this section is to identify the capital costs associated with the total incremental investment identified in the Equipment Investment Section. It is important to note that total incremental investment includes the incremental investment plus the cost of procuring, installing, housing, and operating the incremental investment. The three capital costs contained in this section are the

Depreciation Factor, Cost of Money Factor, and the Income Tax Rate. The source of these inputs is the CAPCOST model. The details of the inputs will be discussed in Summary of the CAPCOST Model. It is important to note that the Annual Capital Cost Factors include the capital costs associated with the particular asset and the capital costs associated the building investment. Only assets that require building investment have capital costs associated with buildings. Each of the Annual Capital Cost Factors is multiplied by the Capital Cost Inflation Factor.

**Annual Depreciation Factor:** This is the depreciation factor used to calculate the annual depreciation expense. See the Depreciation Section later in this report for a discussion of the actual depreciation factors.

**Annual Cost of Money Factor:** The purpose of this factor is to identify the annual cost of money for the particular investment. The annual cost of money reflects SWBT's profit from the investment. The Cost of Capital and Capital Structure for SBC Section for a discussion of the actual capital cost inputs.

**Income Tax Rate:** The purpose of this factor is to identify the income tax expense incurred by using equity financing. This factor is included to ensure that SWBT receives a return sufficient to pay the necessary income tax and still recover its cost of capital. See the Income Tax Section for a discussion of the Income Tax rate.

**Section 3 - Annual Expense:** The purpose of this section is to identify the annual expenses associated with operating and maintaining the total incremental investment identified in the Equipment Investment Section. It is important to note that total incremental investment includes the incremental investment plus the cost of procuring, installing, housing, and operating the incremental investment.

**Equipment Maintenance:** This is the recurring expenses (material and labor) associated with ordinary repairs, rearrangements, and changes to plant. This factor is calculated by dividing the Total Maintenance Expense by Account for the latest year by the Replacement Cost of the Mid-Year Investment in a particular Account for the latest year. Once this factor is calculated it is multiplied times the Operating Expense Inflation Factor (OEInf).

The Total Maintenance Expense tends to be asset category specific but not account specific. These recurring expense for each asset type are allocated to individual accounts based upon investment in each account. For example, switch testing expense is recorded as labor specific to switching but not specific to a specific account such as digital or analog switching. Therefore, the total switch testing expense is allocated among the different switching accounts (analog, digital, etc.) based upon the investment in each account. If one type of switching requires a disproportional share of maintenance, this allocation will not reflect it. Since SWBT's TELRIC cost studies only include one type of switching (digital),

this allocation could overstate maintenance costs for digital switching. This would occur if analog switching actually incurred more maintenance costs per dollar of investment than digital switching. Of course, if analog switching required less testing per dollar of investment than digital switching required per dollar of investment, this allocation could understate the maintenance cost for digital switching.

The Total Replacement Cost of the Mid-Year Investment of a particular asset account is calculated by multiplying the historical, embedded investment times the CC/BC ratio. This increases the embedded asset investment to reflect the current replacement cost of that particular account. The Mid-Year investment number is subject to the same concerns expressed in the Building Factor.

Once this factor is calculated it is multiplied by the OEInf. This calculation is done to make the maintenance expenses forward-looking. The effect of this is to make the numerator forwarding looking while holding the denominator at the current value.

**Building and Grounds Maintenance:** This factor is applied to recover the annual expenses associated with ordinary repairs, rearrangements, and changes to land and buildings. This factor is only applied to asset accounts that require the use of a building. It is calculated by dividing the Building and Grounds Maintenance Expense by the Total Replacement Cost for the Mid-Year Investment in the Buildings and Land Accounts. This factor contains all buildings, including administrative and headquarter buildings in both the numerator and the denominator. Once the factor is calculated, it is multiplied by the OEInf. This is done to make the maintenance expenses forward looking.

An additional consideration is the inclusion of administrative and headquarters buildings in calculating this factor. Since the incremental portion of SWBT's TELRIC studies do not include headquarters and administrative buildings, the inclusion of them in the factor needs further investigation. If administrative and headquarters buildings require more maintenance per dollar of investment than other buildings, the portion of building maintenance allocated to the incremental investment may be overstated. Of course the opposite is true if headquarters and administrative buildings require less maintenance per dollar of investment. The real effect of including all buildings in the calculation of this factor is unknown.

Of greater importance, is the need to ensure that all Building and Grounds Maintenance Expenses are not included in the calculation of common costs. The portion of this expense that is applied to total incremental investment needs to be removed from the calculation of common costs.

**Support Assets/Administrative Factor:** This factor is intended to recover the recurring expenses incurred for support assets that can be allocated to plant specific accounts. These expenses are reported by asset type but not by asset

account. The expenses associated with each asset type are allocated to asset accounts through two different methods.

- 1). A portion of the support asset expense is allocated to each account based upon the investment in each account.
- 2). The remaining support asset expense is allocated to each account based upon the salaries charged to that particular account.

This is the only factor that uses such an allocation scheme.

**Ad Valorem/Miscellaneous Tax:** The purpose of this factor is to recover the taxes levied on the asset values of the plant. This includes all property taxes, franchise taxes, and miscellaneous other taxes. It is calculated by dividing the total Ad Valorem and Miscellaneous taxes paid in 1995 by the Total Plant Investment.

**Commission Assessment:** The purpose of the factor is to recover the cost of the Public Utility Assessment Charge. It is calculated by dividing the 1995 Public Utility Assessment Charge by the Total Intrastate Operating Revenues less Uncollectible Revenues. The Public Utility Assessment charge is based upon revenues not investment. Therefore, it cannot be directly applied to the amount of the investment. In this instance, SWBT defines its revenues as being equal to its capital costs plus its other expenses. Therefore, this factor is applied to the Total Annual Capital Costs and the Annual Operating Expenses.

### **Inflation Factors**

See the Inflation and Productivity Factor Section later in this report.

## **Explanation of CAPCOST Model**

CAPCOST is the model Southwestern Bell Telephone (SWBT) uses to calculate capital costs attributable to specific project investments. The capital costs are depreciation, post tax income (cost of money), and income tax. The model develops these costs recognizing plant survival characteristics, accelerated tax depreciation procedures, planning horizon<sup>4</sup>, and investment tax credit. The model produces factors related to these costs that represent the return on investment needed to cover these costs and give a return to investors.

### **Purpose**

CAPCOST calculates the capital cost factors (depreciation, post tax income, and income tax) associated with network investment for various unbundled network elements including loops, cross connects with SMAS test equipment, nonrecurring costs for unbundled loops, local switching, monthly port charges, tandem switching, interoffice transport, and conditioning. The three capital cost factors produced are then used in the ACES model to calculate the annual capital costs.

### **Concerns**

Since CAPCOST results affect all elements, depreciation, income tax, and cost of money modifications are discussed separately. These factors are discussed below only in the way they interact and are treated in the CAPCOST model. Modifications to these factors are presented in the Depreciation, Income Tax, and Cost of Money sections.

### **Depreciation Factor**

Investments with significant original costs and useful, revenue producing lives exceeding one year are capitalized to an asset account. Recovery of these invested amounts is accomplished through depreciation expense built into rates customers pay. The

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SWBT uses a planning period that accounts for each useful year of an asset's life. Using a planning period at least as long as the total estimated life of the asset ensures SWBT will accurately recover the value of the asset, and will accurately determine the cost of the asset. However, if SWBT does not account for the full depreciation of an asset in determining its cost, the true value of the asset will not be recovered, the asset will not be fully depreciated, and the resulting cost will be inaccurate.

accumulation or degree of recovery is maintained by entries to SWBT's depreciation reserve accounts on a monthly basis.

- SWBT defines the depreciation factor to represent the consumed or economic loss of an asset for the period in which costs are being identified through the cost study process.
- Before calculating depreciation, the service life and net salvage of the plant needs to be defined. SWBT establishes a projected life through Gompertz-Makeham survival analysis to identify how much of the investment will be in service over the useful life. Incremental retirements are then calculated based on the projected useful life.
- The equal life group (ELG) method of depreciation is used to allocate depreciation expense each year. The ELG method assigns higher depreciation rates to investments in earlier years than later years.
- The sum of the fractions of the asset retired each year will equal the average life the asset.
- Depreciation is the procedure used to allocate a portion of the asset investment to each year over the asset's useful life. The depreciation reserve accrues the depreciation expense amounts, and at a given time represents the total of all prior accruals.
- When an asset is retired, both the asset account and the reserve account are reduced by the original investment amount. Gross salvage (if any) is added to and the costs of removal debited from the depreciation reserve.
- The Depreciation Factor is determined from plant retirements, gross salvage value, and cost of removal. The sum of the present values of each year's depreciation expense is compared to the present value of units of the asset in service each year. This ratio represents the amount to be recovered over the life of the asset to cover depreciation expense. This ratio is the factor for depreciation that is fed into ACES.

### **Post Tax Income (Cost of Money) Factor**

CAPCOST utilizes inputs to produce a series of values relating to the capital cost of an investment. An investment is the purchase of an asset usually repaid over several years.

- SWBT defines the Post Tax Income (cost of money) Factor to be the weighted annual cost to the firm of the debt and equity capital invested in the business. It is the amount which must be earned to cover financial commitments to the company's debt holders (interest rate on debt) and to meet the shareholder's

expectations (return on shareholder's investment).

- Not all investments are made at the beginning of a year or end of a year. Some are made whenever needed, so a mid-year investment basis is used for calculating the effects of interest and present values.
- For cost determining purposes, SWBT uses a mid year investment timing. The mid-year investment is the average timing of investment that accounts for investments throughout a year.
- The Post Tax Income Factor is calculated from interest and tax payments, book depreciation, net investment, tax depreciation, salvage, book tax depreciation, tax reserves and debt interest. Total post tax income represents the amount to be earned to cover interest expenses over the life of the asset. Its present value is compared to the present value of units of plant in service. This ratio represents the return on the investment needed to cover interest expenses over the life of the asset.

### **Income Tax Factor**

Investment comes from equity and debt. There is an obligation to maximize stockholder equity and to pay interest on debt. In addition, an income tax is levied upon the equity return paid. Thus, not only does the return need to cover the investment and interest, the return required must reflect income tax incurred during the year.

- SWBT defines the Income Tax Factor to be the amount owed to federal and state governments on the return earned on its investments.
- Income tax expense is the product of the composite income tax rate and the taxable income generated by the investment less any tax credits.
- SWBT calculates a statutory composite income tax rate by adding the statutory federal income tax rate to the statutory state income tax rate.
- The Income Tax Factor is determined from effective taxable income and income tax expense. The present value of income tax expense is compared to the present value of units of plant in service. This ratio represents the amount of return on investment needed to cover income tax expense over the life of the asset. This value is plugged into ACES as the income tax factor.

### **CAPCOST**

The model calculates the annual capital costs associated with the investment on a year-by-year basis over the life of the asset. Time value of money is then applied to each years cost

and each years units in service. Total capital cost is the sum of book depreciation, post tax income and income tax expense.

$$\text{Total CAPCOST} = \text{Book depreciation factor} + \text{Post tax income factor} + \text{Income tax expense factor}$$

- Total CAPCOST represents the amount of return on investment needed to recover all three costs associated with CAPCOST allowing for a return to investors.

## **Cost of Capital and Capital Structure for SBC**

### **Purpose**

This section analyzes the cost of capital and capital structures presented by the parties and contains Staff's proposed cost of capital. This section is organized by issue with each party's position and Staff's critique and proposal. The attached worksheet also summarizes each party's position and contains Staff's analysis.

### **Cost of Debt**

**SWBT:** SWBT includes a cost of debt of \*\* \_\_\_\_ \*\* in the CAPCOST model while SWBT's cost of capital witness, William C. Avera recommends an 8% cost of debt in his rebuttal testimony. The 8% recommended is intended to represent the cost of debt if SBC would have to pay if bonds were issued today. Avera bases the 8% cost of debt upon Moody's Credit Perspective report of the average yield on "A" rated long-term bonds plus 16 basis points for flotation costs. Incidentally, SWBT's embedded cost of debt is about 7%.

**Analysis:** SBC's bonds currently carry a "Aa" rating and have a lower interest rate than the "A" bonds Avera referenced. In addition, the use of the long-term bond rate as a forward-looking cost of debt would assume that SBC would only issue long term bonds. It is likely that if SBC were to issue all bonds today, it would issue some of those bonds with a shorter time to maturity and therefore, have a lower cost of debt. One of Avera's criticisms of AT&T's proposed cost of debt was that it focused on a bond guide that contained many bonds close to maturity and therefore understated the cost of debt. It would also appear that only focusing on long-term bonds would be an equally biased measurement.

**AT&T:** AT&T's witness Bradford Cornell recommends a cost of debt of 7.5%. This is based upon an average of SBC and SWBT bond yields reported in the August 1996 Standard & Poor's Bond Guide. AT&T's cost of debt estimate does not include any allowance for flotation costs.

**Analysis:** The S&P Bond Guide is not a complete reflection of SWBT's cost of debt because it only contains a portion of SWBT's and SBC's outstanding debt issues. Cornell's Direct Testimony stated that he planned to update the cost of debt estimate when more complete data became available (Page 9).